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(From the PRACTITIONER.)



1881.

D. D. Comes, Printer & Stationer.

183 BROADWAY, N. Y.

SOME PRACTICAL POINTS IN DIGESTION.

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THE subject of Digestion and Assimilation has received a decided impetus from the recent Lumleian Lectures delivered before the Royal College of Physicians, by Dr. William Roberts, F. R. S. of Manchester. In considering the digestive ferments and artificial digestion, he laid before us lucidly what has recently been done by physiological experiment and observation, and showed how it bears on practical medicine. We all know, only too well, what a large proportion of the ailments we are called upon to treat, are directly, or indirectly, connected with the digestive act. Not only with the digestive organs, but with those errors of "interstitial digestion" which produce either struma, or tubercle. We all recognize, that failure of the digestive tract is now on the increase, of which dental caries is a part only. Why and how this failure is becoming so distinct and so widespread at present, can scarcely be discussed here. It is sufficient that we recognize the clinical fact.

All digestion is a process of solution by hydration; *i.e.* as starch is converted into sugar by adding a molecule of water to it, under the action of a ferment, so

the albuminoid "proteid" is converted in the stomach into a "peptone" by a like process of hydration. It is easy to see that our food could not very well be stored in soluble form by the vegetable world, which from ammonia, water and carbonic acid, builds up for us starch, sugar, albuminoids, and fats. If soluble in water they would constantly be dissolving in rain. So they are insoluble, and the digestive act renders them soluble, so that they can pass from the intestinal canal, through its walls, into the blood first, and from it again to the viscera and tissues. Let us take the career of starch. The act of bursting the starch granule open by cooking, is a preparatory act of no little value in lessening the demand upon the digestive processes. This is illustrated by the practice of advanced agriculturists who cook the starchy matters of the food of their stock, or ferment them by brewer's grains. Under the influence of the ferment of the saliva starch is converted into sugar. This ferment is known as "diastase;" and an identical "ferment" is produced in the process of malting barley, where the starch of barley is "hydrated" into malt. This barley ferment is now largely used medicinally for ill-nourished infants and invalids, and very useful it is. But the manner in which the makers instruct us to use it in their appended labels, tells how little is really known of the body ferments. On huge gallon bottles of maltine we read that a teaspoonful must be taken after a meal. Now, as it happens, "diastase," whether from saliva or barley, it matters not, is inactive in the presence of an acid; and taken into the acid stomach, as directed, it is inert; simply thrown away so far as it is a ferment, and reduced to the level of other food—no longer a digestor and itself to be digested. It is in the brief time before starchy matter reaches the acid stomach that "diastase" is active and functionally operative. What starch reaches the stomach is, in all probability, left to be digested by the action of the pancreatic ferment.

Well now, what practical lesson is taught us by the possession of this physiological information? In the first place it tells us that children and dyspeptics, as well as invalids, should take their food slowly. It should not be bolted, even when simple milk and porridge; it ought to be well chewed in the mouth and thoroughly mixed with saliva. In fact, time must be given for the saliva ferment to act upon the starch in order that it may be operative indeed. And this brings us to a matter on which a few words may be said with advantage.

All digestion is a process of solution; but for proper perfect solution disintegration is essential and indispensable. The food, no matter whether starchy, albuminoid, or fat, must be reduced to tiny minute particles before the ferments can act efficiently. We grind our corn before we cook it. We desintegrate it before it is subjected to a process which chemically affects it. That is, so much "digestion" is actually performed upon the food before the digestion of the body is brought to bear upon it. So we cook our flesh in order to make it less tough, *i.e.* in order to make the tiny fibrillæ of the muscles fall more readily asunder. This reduces the act of chewing very considerably and so reduces the work of digestion. The flesh of the pig and calf is especially indigestible, because it is not readily disintegrated; as dyspeptics know to their regret when they have been indiscreet enough to partake of either, often when some persuasive woman's voice has persuaded that "that *little* piece can't hurt you." These persuasive women are valuable allies for the profession! Cooking and mastication then reduce the labour of the stomach in disintegration. And again we see how bad teeth, and habit of eating, rapidly lead to indigestion. With bad teeth mastication is imperfectly performed, and disintegration by the movements of the stomach rendered more difficult, and also painful. The digestion in the

stomach is thus converted from a painless, rather comfortable matter, to a painful and uncomfortable matter. The food should then be thoroughly chewed for divers reasons.

Now we can profitably return to the matter of the effects of artificial diastase. It is quite clear that children and invalids should be taught to eat slowly, and mix their food patiently with saliva. The dairy farmer's wife and maids used of old to patiently feed their calves "off the finger," *i.e.* they made the calves lick the milk from their fingers, and so it got well mixed with saliva. But the increasing pace at which we live has reached the slow-going agriculturist, and now the calves are allowed to bolt their milk, with the natural consequence of too firm curds in the stomach, diarrhoea to get rid of them, a bottle of medicine to stop nature's efforts, and an increased mortality among calves. So when children do not eat slowly, their digestive processes are embarrassed; and especially is this the case where the milk teeth are decayed.

Then again, in order to aid the defective action upon starch by the natural diastase being deficient in quantity or impaired in power, we add the artificial diastase "maltine." But, as Dr. Roberts points out, in order to make this ferment operative, it must not be taken after a meal is over. Rather it should be added to the various forms of milk porridge or puddings before they are taken into the mouth. About this there exists no difficulty. Maltine is a molasses-like matter and mixes readily with the milk, gruel, &c., without interfering either with its attractiveness in appearance, or its toothsomeness; indeed its sweet taste renders the gruel, &c., more palatable. A minute or two before the milky mess is placed before the child, or invalid, the maltine should be added. If a certain portion of baked flour, no matter in what concrete form, were added to plain milk, and some maltine mixed

with it, before it is placed on the nursery table, we should hear much less of infantile indigestion and mal-nutrition.

And one practical point must be well borne in mind. In the present *furor* for fluid beef juice now much prevailing, beef-tea—the stronger the more beneficial of course think the laity; of Liebig's extract &c., &c., the necessity for starchy matters is being quite overlooked or, to be very safe, underestimated. These meat products furnish, the best of them, little glycogen, or animal starch, and yet that is the fuel-food of the body *par excellence*. We must be more guided by rational knowledge, by physiology, and not by fashion in our dietetics. When there is a very feeble digestion then the digested milk, and milk gruel advocated by Dr. Roberts must be employed. Full directions for their preparation are provided along with each bottle of the *Liquor Pancreaticus* which he advocates for artificial digestion.

Such preparations are indicated when milk curdles too firmly in the stomach; and the resultant curd resists the solvent action of the gastric juice, and passes per anum in such quantity that it can be seen in the stools. Whether in typhoid fevers, or other conditions, it is well to attend to this point. For solution, disintegration is indispensable, if the curd formed in the stomach is too firm to be broken to pieces, then the milk cannot be digested. When such firm curdling is present, whether in child or adult, then it must be dealt with. In milder cases equal quantities of milk and lime water, with a teaspoonful of baked flour mixed in each pint, will check the excessive curdling. Here the particles of the flour mixed with the milk undergoing the curdling process, mechanically render the curd less firm and tenacious. If the acidity be still more pronounced then it may be necessary to mix ten grains of prepared chalk or five grains of carbonate of magnesia to each pint of milk, or milk and water, along with the baked flour. If beef-tea, or mutton-

broth be taken, it is well to add to each pint a tea-spoonful of baked flour, or fine oatmeal, or maize flour; or even some boiled arrowroot, which is very thin. Such addition is requisite to give the meat extract a higher food-value.

Then comes the question of the digestion of albuminoids. Under the influence of the gastric juice an insoluble albuminoid, a "proteid" is converted into the soluble "peptone." As such it passes into the blood, where it at once passes back to proteid form. This digestion into a "peptone" is achieved by the addition of a molecule of water, and as soon as the soluble peptone has reach the blood it is dehydrated back to a proteid. This is the special function of the stomach, viz. to digest albuminoids. And here again we see that disintegration is essential to solution. If the albumoid be flesh it must first be cooked, which makes it tender, so that one minute fibril readily parts from its next neighbour. And as persons advance in years they usually prefer their meat well done, while youthful appetites like underdone meat generally. Then it must be masticated so as to thoroughly break down the separate fibrillæ. If these two preparatory operations have been imperfectly performed, then the work of the stomach is increased. Hence the movements of the stomach are active and prolonged, so that the individual becomes conscious of them; this is the indigestion of "imperfect disintegration." This form of dyspepsia is very amenable to treatment, and the indications are plain enough. Suitable food must alone be taken, mastication must be efficient and careful. If the teeth are decayed, the dentist must be consulted and false teeth if necessary supplied. Practically milk puddings, with or without stewed fruits, "steam-cooked crushed cereals" to be procured of leading grocers; fish, especially short fibred white fish, and the white flesh of fowls, are to be preferred. Let the time spent at meals be sufficient for proper mastication, and the mixture of the saliva with the starchy or gly-

cogenous matters of the food; by this last the starch is converted into sugar, which being soluble, passes from the stomach to the blood, and the gastric digestive act is not embarrassed by the presence of too much starch. These little matters reveal their practical importance under the bright light which advancing physiology is throwing upon them. They have long been known to careful clinical observers empirically, and as matters of fact, but now we know them scientifically, which reveals their importance to all. Thus perfect disintegration is essential in all cases of dyspepsia. After that comes the question of "solution."

Digestion is really solution. The gastric juice is the solvent of the albuminoid elements of our food. Now when this juice is secreted in insufficient quantity, or is impaired in quality, then the solvent process does not progress properly. We have then indigestion from imperfect action of the gastric juice. Having secured for the patient a suitable dietary, and as perfect disintegration as the circumstances of the case will permit, we come to the next matter, the gastric juice. We must secure more gastric juice, or a better quality of it. For this end we stimulate the secretion by appropriate measures, or we employ artificial digestive agents, procured from outside the organism. For the purpose of whetting the appetite and thus acting reflexly upon the gastric secretion, we employ the class of agents known as bitters. To this we add hydrochloric acid. Ringer has pointed out how an alkali, taken into the stomach before a meal when the stomach is alkaline, produces a freer flow of acid afterwards. Consequently we comprehend the value of that well-known preparation indifferently termed, "Haust. Stomach," or "Mist. Mirabilis," or "Mist. Rhei-et Gentian," in the various hospitals, a combination of worldwide fame. One drawback to this combination of rhubarb, gentian, and soda is that the student becomes familiar with it, and its virtues, but remains ignorant of its exact composition, and so loses sight of

it when he enters upon practice for himself. Such a mixture, before meals, followed by ten drops of hydrochloric acid after the meal, will often make the difference betwixt imperfect digestion, producing discomfort, and digestion so perfect that it does not provoke consciousness. Or where there is much irritability in the stomach, *i.e.* when a bare red tongue imperfectly covered with epithelium suggests a like condition of the internal coat of the stomach, then bismuth is most soothing. The mixture of soda, bismuth, and calcimba is in use for such indigestion with good results. The dietary in such a case should consist of the blandest food, milk, with or without baked flour in it, beef-tea with baked flour, nothing more till an improved condition of the tongue tells of a more normal condition of the stomach. In such cases a plain opium-pill at bed-time often soothes the stomach very nicely. Then there are cases where imperfect digestion is accompanied by the production of fatty acids, butyric and others, which add the phenomenon of "heart-burn" to the symptoms; or they may be later products formed which cause the bitter hot taste in the mouth on awakening in the morning or after a post-prandial nap. It is usual to treat "heart-burn" by the exhibition of an alkali, but this is not good practice. In union with an alkali the offending matter is nearly as objectionable as in the form of free acid. It is much better to give a mineral acid, as the hydrochloric, or phosphoric, which breaks up the feebler organic acid. By such means we can aid the digestive act. Then at other times the indigestion is due to lithiasis, where the presence of uric acid impairs the efficiency of the gastric juice. In these cases all measures which do not entertain the casual relations of the dyspepsia are of little use. By the administration of potash in a bitter infusion well diluted, taken half an hour before a meal, this element of trouble is removed. In all cases of gouty persons suffering from dyspepsia, do not forget this cause of impairment of the gastric juice.

Having thus cleared the digestive act of all impeding factors, there comes the question of direct stimulation of the flow of gastric juice. We know that there are agents which in considerable quantities excite inflammation of the coats of the stomach, and which, when taken in medicinal doses merely, increase the vascularity of the gastric mucous membrane, and so stimulate the flow of gastric juice. Such agents we possess in arsenic, and ipecacuan, and certainly alcohol. The action of the latter is often excellent in weak digestion, either taken with the food, or as a tumbler to the appetite immediately before food. This is seen in "the nip of gin and bitters" so commonly taken before dinner by men who wish to thoroughly enjoy their food.

Ipecacuan formed a portion of a good old-fashioned dinner pill; and betwixt its direct action upon the gastric mucous membrane, and its action upon the liver as an hepatic stimulant, it must come into use again before long. A dinner pill of:—

Pulv. Ipecacuan, gr. j.

Strychniæ, gr. $\frac{1}{20}$

Pulv. Pip. Nig. m. ii.

Pil. Al et Myrrh, gr. ijs.

every day will often produce excellent effects. Then arsenic may be taken as three drops of Fowler's Solution after dinner; or in the above pill substituting the same dose of arsenic for the strychnine.

Beyond these measures lies the use of artificial pepsine. Pepsine if properly prepared will digest albuminoid bodies outside the body. The pepsine of the pig or calf is potent within the human stomach. But as pepsine only digests albuminoids in an acid medium, it is clear it must be given shortly after a meal. And from what has been said before, it is quite clear that in each case the medical attendant must distinguish betwixt the indications for giving maltine to digest starch, and pepsine to digest albuminoids. There is room for fear that this distinction is not invariably

made as carefully as it ought to be made. Yet it is evident that in every case such discrimination is necessary for its right management, and it will not do to give maltine or pepsine indiscriminately. By careful attention to these different matters, clearly distinguishing the indications for treatment in each case, the difficulties can usually be surmounted successfully; but it is by no "happy-go-lucky" plan, or rather want of plan, which will enable the practitioner to so diet and treat these patients, as to be generally successful. A chance success here and there may be attained, but systematic success can only be hoped for by systematic study of the subject.

All this time fat has never been discussed. The digestion of fat is not affected either by the saliva or the gastric juice. It is a moot point, yet, how far some portion of the fat in the stomach may not be broken up into fatty acids and glycerine, and that these fatty acids may aid the bile and the pancreatic juice in the emulsionising and saponifying of the rest of the fat. But the digestion of fat takes place beyond the stomach, to speak broadly. When the contents of the acid stomach pass the partially relaxed pyloric ring, they come into contact with the bile and are rendered alkaline. And then the action of the pancreatic secretion comes into play. About this last matter older practitioners know little. That is not their fault however. The subject is one which has been cleared up since their student days. The pancreatic secretion contains four principles: (1) a ferment which changes starch into sugar; (2) trypsin which digests albuminoids in an alkaline medium; (3) a substance which will curdle milk; and (4) another substance which will emulsionise fats. Consequently contrary to what is thought by many, it is beyond the stomach that the greatest digestive activity occurs. When the contents of the stomach pass into the small intestine the pancreatic secretion commences its operation. The remaining starch, unconverted into sugar by the saliva,

is acted upon now, once more; the albuminoids not already digested by the gastric pepsine are digested by the pancreatic trypsin, while the fats are emulsionised so that they can be taken up by the lacteals in the villi of the intestines. Here then we have digestive activity in its most pronounced form. But of indigestion here we as yet know nothing; we merely know that fat is not digested in certain cases. Yet there are some matters connected with the digestion of fat which are not made as much the subject of thought as they ought to be. There is the broad fact that cod-liver oil, cream, butter, the liquid portion of fried bacon, are the most digestible fats; that these can often be assimilated when the ordinary fat of meat is not digested, and is turned from with loathing. Many a child will reject with disgust the fat of meat, so sweet and toothsome to many persons with good assimilative powers, and readily take cod-liver oil; admitting that the latter is not attractive by its taste. There is clearly something here in the albuminoid envelope of the animal fat. Fat as found in the bodies of animals, consists of connective corpuscles crammed with fat globules. Before such fat can be digested the albuminoid envelope must be removed. How far this film of connective tissues interferes with the digestion of the fat contained in it, we cannot yet say. But the facts stand in a very suggestive relationship.

Now what means have we for influencing this portion of the digestive act? Again we may stimulate the pancreas, or fall back upon artificial pancreatic secretion. For the purpose of stimulating the pancreas we possess one agent alone of which we as yet have any knowledge. This is sulphuric ether. Dr. Baltazar Foster, of Birmingham, first brought forward ether for this purpose, giving it with cod-liver oil, where the oil alone did not seem to be assimilated. This work has been corroborated by the report of a commission appointed in the United States of America to investigate the matter. It is certainly a measure well worth trial in cases where pancreatic digestion is impaired.

Then there is the use of pancreatic secretions obtained from that useful omnivorous animal, the pig. These, if well made, are of great potency, and are not objectionable in taste. We all know that Dr. Horace Dobell has long had before the profession a "Pancreatic Emulsion" for the treatment of phthisis especially. There can be little if any doubt about the fact that it is the imperfect assimilation of fat which impairs "interstitial digestion" in the body. This impairment gives us those modifications of nutrition which are summed up in the word "struma." We know that if we can manage to enable a patient with pulmonary phthisis to digest and assimilate cod-liver oil, tissue nutrition becomes so altered that the development of tubercle is usually arrested. That is, we have once more given to growing tissue that fat which is essential to healthy formation. Call growths of tubercle by what name each man pleases, Virchow's broad view that tubercle is a growth of connective tissue corpuscles degraded in quality, while produced in great quantity, is the one to hold in order to best grasp the subject from its therapeutic aspect. What we have to attempt to do is to give to the tissues the fat without which they are not healthy. Now the perusal of the foregoing remarks will tell every reader, him that reads and runs, as well as him who reads slowly, that in the treatment of tissue malnutrition, whether of phthisis, or some other form, there are many points to be attended to beyond ordering cod-liver oil, or change of air. The last, as being directed almost solely to the effect of the inspired air upon the lining membrane of the air tubes locally, is a very narrow and limited view of phthisis; and it is desirable that the doctors who sing the praises of different health-resorts should know a little more of general medicine, and be a little less taken up with the atmospheric disturbances, and the mere number of hours of sunshine of different localities. For instance, a young lady was sent to Davos the winter of 1878-79, and

came back considerably improved. She after that came under my notice professionally, and I put her upon a course of pills containing arsenic and iron. On this she improved nicely, and I insisted upon her continuing the medicine during her stay at Davos last winter (1879-80), so as to derive the maximum benefit for the heavy expenditure. But when she got to Davos her doctor stopped the medicine without any communication with me in the matter. What are the consequences? She comes back in such a condition that her mother gives her the pills again, on which she soon improves. Now will any reasoning being believe that if that course of arsenic and iron had been continued during the stay at Davos, the girl would not have been all the better for it?

In tissue-malnutrition it is not sufficient to merely order cod-liver oil and change of air, as is evident by what has gone before; but to first see that the digestive and assimilative processes are going on properly; that the food contains the requisite quantities of nutritive power with ready disintegration; that the natural digestive ferments are encouraged, or supplemented by artificial ferments: and then comes the question of the assimilation of fats. The last is the crowning point of the therapeutic edifice, not its foundation. It should not be the first thing done to order the cod-liver oil, but to lead the organism up to its ready digestion, and ultimately to that of other less digestible but more stable fats. Then it is of the utmost moment always in disease to watch the condition of the tongue and the humours of the stomach. However capricious the latter, it must be humoured and conciliated; and whenever the tongue becomes denuded of its epithelium, or is covered with a layer of dead epithelium, the plan of treatment must be at once suspended; and if nausea or eructations follow the oil, then for a time it must be withheld. No matter how tantalising to see a satisfactory progress checked, submission to the stomach is essential; to pursue the same

line when the stomach is disturbed is not good generalship. To retire for strategic purposes is not always the equivalent of defeat; it may be a wise and prudent manœuvre. Very often indeed the ultimate result of a case hangs upon the readiness with which this strategic manœuvre is executed. It is to be feared that the clinical skill of a generation or two ago in these matters of apparent minutiae, have been largely forgotten by a race who study disease in the dead-house; and who look at tissues, healthy and diseased, too exclusively through a microscope. When the stomach will not tolerate milk, or milk and seltzer water, or lime-water, even in small quantities, and great discomfort, only relieved by vomiting, follows any ingestæ, then the case is very serious. In such cases then we may fall back upon the artificially digested milk and milk-gruel of Dr. Roberts. Full directions are given along with each bottle of the Liquor Pancreaticus, without which the artificial digestion cannot be carried on, so they need not be repeated here. Further, a nutritive enema, with the requisite digestive ferment in it, is also described on the wrapper. It is not only that Dr. Roberts' work is good and sound and valuable in itself; but it has a further and almost priceless value in its suggestiveness, and the thought about the matter of digestion in the minds of others which it is exciting.

